The present invention is an apparatus for measuring critical parameters used in manufacturing of capital goods in microelectronic processing without evasive interruptions to manufacturing equipment. In preferred embodiments the critical parameters are selected from the group consisting of temperature, liquid and gas flow rate, distance, particles, humidity, pressure, viscosity, radiation, velocity, density, acceleration, stress/strain, and pH. In preferred embodiments, the critical parameters are related to chemical/material analysis techniques selected from the group consisting of Energy Dispersive X-ray Spectroscopy (EDS), Cathodoluminescence (CL), X-ray Photoelectron Spectroscopy (XPS), Ultraviolet Photoelectron Spectroscopy (UPS), Auger, Electron Spectroscopy (AES), Reflection High Energy Electron Diffraction (REELS), X-ray Fluorescence (XRF), Photoluminescence (PL), Modulation Spectroscopy, Variable Angle Spectroscopic Ellipsometry (VASE), Fourier Transform Infrared Spectroscopy (FTIR), Raman Spectroscopy, Solid State Nuclear Magnetic Resonance (NMR), Rutherford Backscattering Spectroscopy (RBS), Elastic Recoil Spectroscopy (ERS), Ion Scattering Spectroscopy (ISS), Residual Gas Analyzer (RGA), Dynamic/Static Secondary Ion Mass Spectroscopy, Laser Ionization Mass Spectroscopy (LIMS), Sputtered Neutral Mass Spectroscopy (SNMS), Glow Discharge Mass Spectroscopy (GDMS), Inductively Coupled Plasma Mass Spectroscopy, Inductively Coupled Plasma Optical Emission Spectroscopy, Neutron Diffraction, Neutron Reflectivity, Neutron Activation Analysis (NAA), Nuclear Reaction Analysis (NRA) and combinations thereof. In a preferred embodiment, the apparatus comprises one or more sensors, the one or more sensors attached to surfaces on the capital goods for collecting

data therefrom. The invention also comprises an electronic device for processing data collected from the one or more sensors, and an energy source for the electronic device, wherein said sensors and electronic device reside completely on the surface of the capital goods. In a preferred embodiment, the electronic device comprises one or more of the following: an analog to digital converter, a signal conditioning device and a data recording device. A preferred embodiment further comprises an external wireless receiving module wherein the collected data is transmitted digitally in real-time from the electronic device to the external wireless receiving module, and wherein the data can be further utilized as desired. In a preferred embodiment, the electronic device further comprises a solid state memory device wherein the collected data is stored locally on the solid state memory device such that the data can later be downloaded and utilized. Optionally, the solid state memory is selected from the group consisting of Electrically Erasable Read Only Memory (EEPROM), Ferroelectric Random Access Memory (FeRAM), Magnetic Bubble Memory, Flash, Dynamic Random Access Memory, Static Random Access Memory, First In / First Out (FIFO) and Giant MagnetoResistive Random Access Memory (GMRRAM). In a preferred embodiment, the energy source comprises a battery functional at elevated temperatures up to 15O°C. Optionally, the battery is selected from the group consisting of lithium metal, lithium ion. and Nickel Metal Hydride NiH) batteries. A preferred embodiment further comprises an insulation to isolate the material to protect the electronic device from hostile manufacturing or processing environments. Optionally, the isolation material is selected from the group consisting of material with low thermal conductivity, material with low emmisivity, and

material with low convectivitv. Optionally, the isolation material is selected from the group consisting of silica aerogel, carbon aerogel. silica whiskers, vermiculite, stabilized zirconia, clay, and combinations thereof. Optionally, the isolation material is a material with a high resistance to chemical attack or a material with low permeability. In a preferred embodiment, the one or more sensors, electrical device and energy source operate in a vacuum. In a preferred embodiment, any one of the one or more sensors, electrical device and energy source are hermetically sealed, such that the apparatus is particularly adapted to operation in a vacuum environment. In a preferred embodiment, the one or more sensors, electrical device and energy source are radiation hard, for operation of the apparatus in environments containing radioactive substance. Optionally, the isolation material isolates the one or more sensors, electrical device, and energy source from environmental radiation during operation of the apparatus in an environment containing radioactive substance.